

Chapter 6 – General Safety (REDACTED)

6.1 Purpose

This chapter provides general safety requirements for personnel employed by or working at Ames Research Center (ARC) not specifically covered in other chapters.

6.2 Applicability

This manual is applicable to: (1) all Ames Employees; and (2) all persons and entities who agree in writing to comply with this manual.

6.3 Authority

Safety requirements in this chapter are primarily from the Occupational Safety and Health Act of 1970. The requirements of this public law are published as regulations in Title 29 of the Code of Federal Regulations, primarily in Parts 1910 and 1926. Other safety requirements or recommendations found in this chapter originated in National or International Safety Standards.

6.4 Responsibilities

1. **Safety Division:** The Safety Division responsibilities are listed in Chapter 2: Safety & Health Responsibility.
2. **Ames Health Unit:** Ames Health Unit responsibilities are listed in Chapter 3: Ames Health Unit.
3. **Branch Chiefs:** REDACTED
4. **Supervisors:** REDACTED
5. **Employees:** REDACTED

6.5 General Safety Concepts and Requirements

Safety is approached in a disciplined and systematic method at ARC. The primary steps in the program are to identify, evaluate, and control the hazards present in each workplace.

After workplace hazards are identified and evaluated, engineered and/or administrative controls are applied to either eliminate the hazard or minimize the consequence of the hazard. Controls may include machine guarding, excluding personnel from an area, restricting the amount of time employees spend in an area, adding or upgrading ventilation, developing safe work procedures, using personal PPE, or training. The last step in the process is frequent periodic assessments and inspections to ensure that controls are in place, are being used, and are effective.

Although safety controls may vary significantly from one workplace to another, a number of common controls help contribute to a safe working environment regardless of location or task. These requirements are discussed in the following sections. Specific guidance on identifying and controlling facility hazards can be obtained from the Safety Division.

6.6 Reporting Emergencies and Injuries

An emergency is defined as any abnormal situation that requires immediate action because it could adversely affect personnel health and safety, the environment, or the Facility mission. Examples include serious injury, fatality, fire, automobile accident, criminal activity in progress, damaged gas or water supply lines, flooding, leakage or spillage of toxic, caustic, or corrosive chemicals, electrical accidents, etc. All personnel are encouraged to review the Building Emergency Action Plan (BEAP) for buildings they occupy and attend annual BEAP training.

Whenever an emergency of any kind occurs, notify the Moffett Dispatch. **DIAL 9-1-1**, day or night, any day of the week, from any Center telephone. (EXCEPTION: Pay phone 9-1-1 calls go directly into the Mountain View Emergency Center. If using a pay phone, you must dial **REDACTED** or inform the dispatcher you are calling from Moffett Field.) All Center telephones have decals showing this extension, and it is posted at numerous locations around the Center. Provide the duty officer with all the information you have relating to the nature of the emergency and the location (building number, location in the building, etc.). Do not hang up until the Dispatch has the necessary information and releases you.

If safe to do so, post guides in front of the building to direct emergency personnel to the scene of the emergency and to restrict other personnel from entering the area. Stand by to render assistance and supply further information as requested. Personnel responsible for emergency response and/or mishap reporting and investigation are referred to in Chapter 4: Mishap Reporting and Investigating.

All occupational injuries/illnesses must be reported to the supervisor and the Ames Health Unit immediately. Supervisors are required to complete and submit NASA Form 1627 within 24 hours of the incident. During normal working hours, injured civil servants must report to the Ames Health Unit for treatment.

6.7 Housekeeping

Good housekeeping is the best method of controlling the risks of injury and fire within a facility. Operating experience clearly indicates a significant increase in mishaps related directly to poor housekeeping practices. To be an effective risk management tool, housekeeping must include the following considerations:

1. Storage space must be physically adequate for the volume of materials being stored. If it is inadequate, and adequate space cannot be obtained, dispose of the material.
2. Stored materials must be in a stable configuration in order to permit safe access, avoid clutter, and minimize the hazard of falling materials.
3. Materials stored together must be compatible. Materials must not contribute to, or cause ignition of, other materials, nor enhance their rate of combustion once ignited.
4. The fuel load (combustible mass) within the storage areas must be consistent with the fire detection system and the risk management criteria for the area and the building.
5. Working and walking surfaces should be dry, smooth, and free of general clutter and provide good traction for walking.
6. Equipment and tools, especially those with sharp surfaces, must be kept in their designated storage location when not being used.

It is well established that the quality and quantity of work are significantly enhanced by good housekeeping and adversely affected by poor housekeeping. Supervisors must expend the necessary effort to achieve and maintain a neat and orderly work environment.

6.8 Working Alone

6.8.1 Employees

A person who is performing his work while out of audio or visual contact with a coworker is considered to be working alone. For safety reasons, working alone is not permitted under hazardous conditions. Examples of hazardous conditions include:

- Electrical work on high voltages (over 600V), on switching equipment, or in remWork on high-pressure equipment (pressures above 15 psig, excluding shop air or instrument supply air up to 140 psig in lines not exceeding $\frac{1}{2}$ -inch diameter).
- Chemical laboratories during hazardous chemical operations.
- Activities using explosives.
- Work involving machine tools (as in machine shops) and moving equipment.
- Work involving use of Class IV lasers, radioisotopes, and radiation equipment,
- Work in permit-required confined areas (a confined area is any location where there is a possibility of an accumulation of gases that may be toxic or combustible, that create an oxygen deficient condition, or that may cause loss of consciousness or awareness. Examples include tanks, test chambers, sewers, manholes, pits, and tunnels. Under certain conditions, an open area or a large room may be susceptible to this hazard in a localized condition.

Work with cryogenic materials or containers.

6.8.2 Managers

Supervisors may place additional limitations on working alone whenever, in their judgment, the work situation constitutes an undue risk to employees' safety.

Supervisors must establish written procedures for periodically checking on the physical condition of employees who are working alone. These procedures may consist of personal contact, radio paging, television monitoring, or other arrangements, as long as the safety of those working alone is assured. The time between contacts with the person working alone will depend on the work conditions and the nature of the hazards to which the person is exposed. Since there are few people available between 4:30 p.m. and 8:00 a.m. and on weekends and holidays, special arrangements are required to protect people who are working alone during these times.

6.9 Safety Lanes and Barricades

Safety lanes and safe-access lanes are typically floor markings that identify safe passage through or out of shops, warehouses, and similar locations. They also identify access lanes to control panels and emergency equipment, which must be kept clear and unobstructed. They must be clearly marked with either clear yellow or yellow-and-black striped lines, or by plastic tape affixed to the floor.

Barricades are used to identify and deny access to hazardous areas. Use of barricades must be coordinated with the Institutional Operations Office and with the Research Facilities and Instrumentation Division. The following precautions are to be taken:

1. Excavations, breaks in roads or floors, and similar conditions must be barricaded to prevent injury to personnel and reduce the possibility of damage to equipment and vehicles.
2. Barricades must be provided with appropriate flashing lights during nighttime hours and periods of reduced visibility.

3. Barricades must be placed far enough in advance of the actual working area to prevent traffic congestion.
4. Adequate signs (such as "Road Closed," "Aisle Blocked," "Detour," etc.) must be used in conjunction with barricades.
5. Breakaway links must be used in all chains that barricade an area in order to permit ready access by fire fighting equipment. Such chains must be identified by the "international orange" color.
6. Work performed at heights can jeopardize persons at floor level as a result of falling objects. Such floor-level areas must be barricaded. Areas where ladders, scaffolding, or staging are being used must also be barricaded as a protection against falling objects.
7. Areas where explosives are being used must be barricaded.

6.10 Hazard Labeling and Posting

6.10.1 General Labeling and Posting

Labels and postings are used to identify safety hazards and provide instructions. The letter, color, format, and word requirements of ANSI Z535.2-1991 will be used to convey safety-related information on signs. All employees must comply with posted warnings and instructions. In general, the following color codes are used:

1. Red sign - With white and black, communicates a **DANGER** statement where an imminent hazard present would cause serious personal injury or death,
2. Orange sign - With black, communicates a **WARNING** statement where a potentially hazardous situation could result in serious injury or death,
3. Yellow sign - With black, communicates a **CAUTION** statement where a hazard could cause minor or moderate personal injury, or alert against an unsafe practice,
4. Blue sign - With white, communicates a **NOTICE** statement pertaining to a company safety policy,
5. Green Sign - With white, communicates a general safety message.

Signs restricting access for safety reasons must also be obeyed. Instructions such as "**Do Not Enter**" or "**Authorized Personnel Only**" must be observed. Authorization for entry to such posted areas must be received from the responsible Manager. A written access authorization listing is suggested for areas containing ill defined or intermittent personal hazards. Contact the NASA Safety Division for assistance with hazard posting.

6.10.2 Pipe Labeling

Because of the potential hazards associated with pipe transfer systems, piping must be labeled accurately as to the contents and intended direction of flow. The current edition of ANSI 13.1, Scheme for Identification of Piping Systems, is adopted.

The following table summarizes the Ames policy. Designers and facility managers should refer to the ANSI standard or the Ames Standard Construction Specifications for additional details.

Table 6.10.2
Piping and Utility Line Labeling Color Scheme Policy

Piping/Utility Contents	Pipe & Label Background Color	Label Lettering Color
Material Inherently Hazardous		
Flammable or Explosive, Including Natural Gas	Yellow	Black
Chemically Active or Toxic Temp >140° Gas Pressure > 150 psig Liquid Pressure > 500 psig	Yellow	Black
Radioactive	Yellow	Black
High Temperature or Pressure	Yellow	Black
Material of Inherently Low Hazardous		
Liquid or Liquid Admixture	Green	White
Gas or Gaseous Admixture	Blue	White
Fire Suppression Agents		
Water, Foam, CO ₂ , Halon, etc.	Red	White

Notes:

1. Directional flow arrows and other piping symbols shall utilize the color codes shown above.
2. Insulated piping where the outside surface is a non-ANSI color will use properly color-coded labels.
3. Labels shall be applied in locations visible from the ground and close to valve systems. They shall also be applied at appropriate intervals along the piping run.
4. The Center's vacuum systems are considered non-hazardous. Labeling and color-coding are not mandatory under this policy. Their use is encouraged for traceability or aesthetics at the discretion of the designer or facility manager.
5. Previously specified radioactive markers are acceptable if already installed or until existing supplies are depleted.

6.10.3 Floor Load Posting

The approved floor loading for each building level shall be permanently posted in a conspicuous location. These signs shall not be removed, obscured, altered, or modified by anyone without the authorization of the building owner.

6.11 Office Safety

All work areas contain some level of occupational hazards, including office and non-shop or research work locations. The following is a listing of safety precautions that should be observed at all locations:

1. Electrical
 - Use only Underwriters Laboratories (UL) or other testing laboratory-approved electrical devices.
 - Do not overload electrical outlet circuits.
 - Limit extension cords to one unit per outlet.

- Extension cords must be of the three-pronged grounded variety, and suitable for the conditions of use and location.
 - Do not use electrical devices outside or in a wet environment unless protected by Ground Fault Circuit Interrupter (GFCI) devices.
 - All cords should be protected against kinks, crimps, or other damage. They should not run through doorways where they could be damaged by a closing door.
2. File Cabinets
 - The heaviest items stored in each cabinet should be located in the lowest drawers to prevent toppling.
 - A loaded cabinet should be limited to one open drawer at a time.
 - The top shelf should not be loaded with anything that could cause an injury if it fell.
 3. Fire Hazards
 - Employees shall not attempt to fight fires with portable fire extinguishers or fire hoses unless they are qualified by training to do so. Fire extinguisher training is provided on a regular basis. Registration for this class can be accomplished by submitting ARC Form 301 to the Safety Division.
 - Use only personal space heaters equipped with tip-over protection.
 - See Chapter 20: Fire Protection, for more detailed requirements.
 4. Ergonomics
 - Use the correct tool, procedure, and posture for lifting heavy items.
 - Configure repetitive motion workstations (e.g., computer) to maintain good posture and avoid straining, stressing, or fatiguing any body component.
 - Further information is available in Chapter 36: Ames Ergonomics Program.
 5. Sharp Surfaces
 - Sharp surfaces on equipment and furniture (e.g., file cabinet edges, wood splinters, etc.) should be removed or protected to eliminate injury potential.
 - Cutting knives (e.g., Exacto, utility knife, etc.) should be stored with the cap on or blade retracted.
 6. Emergency Exits and Egress Routes
 - Emergency exits must never be blocked.
 - Emergency exit lights should not be obscured.
 7. Building Alarms
 - Employees must understand the meaning of alarms in all buildings and areas they work in or visit on a regular basis, and must be aware of the appropriate response to each alarm. Refer to the BEAP for additional information on building alarms.
 8. Ladders
 - Ladders must be used, stored, and inspected as specified in Chapter 14: Shop Safety.

6.12 Hand Tools

Supervisors are responsible for the safe conditions of hand tools and equipment used by employees, including tools and equipment that may be furnished by employees.

6.12.1 Non-Powered Tools

Non-powered hand tools are required to meet, as a minimum, the following restrictions. This is not a complete listing of such hand tools, but the same principles apply to other tools of the

same general type. Further information on hand tools may be obtained from the Institutional Operations Office.

1. Hammers:

- Hammerheads must be securely mounted on handles, and hammer faces must be free of cracks or irregularities.
- Hammers must not be used as prying tools, and must be used for their intended purpose.
- Driving nails with a machinist's hammer is prohibited. Use soft-faced hammers or tempered tools, etc.

2. Wrenches and Pliers:

- Wrench and pliers jaws must be in good condition. Excessively worn tools must be discarded.
- Adjustable wrenches must be snugly fitted to the nut before applying pressure.
- Extension handles ("cheater bars") must not be used.

3. Screwdrivers:

- Do not use a screwdriver with a broken or bent blade.
- Do not use screwdrivers as chisels or punches, or for prying.
- Use screwdrivers with insulated handles for electrical work.

4. Files:

- Files, other than Swiss files, must be equipped with handles.
- Files must be kept clean.
- Do not use files as punches or chisels, or for prying.

5. Knives:

- Knives must be kept sharp and clean.
- Keep knives in protective containers or sheathed when not in use.
- Do not use knives in place of saws, chisels, etc.
- Cutting with knives requires complete concentration and care.

Employees must not use knives when safer tools will do the job.

6.12.2 Powered Tools

The non-powered hand tool requirements also apply to powered hand tools. In addition, powered tools must be used only when in safe mechanical condition.

- Electrical Powered Tools

- Electrical tools must be equipped with a three-wire (grounded) power cable and a three-pronged (grounded) plug.
- Attachments used with electrically powered hand tools must conform to the rating, RPM, etc., of the tool. Operating limits must not be exceeded.
- Electrically powered tools must not be used if arcing is noted.
- Electrically powered tools must not be used in areas where there are combustible gases or vapors.
- Cords of electrically powered tools must be safeguarded against crushing, pinching, cutting, and crimping. Any break in the insulation is cause for replacing the cord. Patching or taping the cord is not permitted.
- Electrically powered tools must not be lifted by the cord.

- Safety devices must be maintained on electrically powered tools; for example, the blade guard on a circular saw.
- Air-Powered (Pneumatic) Tools
- Attachments to air-powered tools must conform to the tool rating with respect to RPM.
- All safety devices must be maintained on air-powered tools. For example, a rivet gun must be equipped with a rivet set retaining spring at all times.

See Chapter 14: Shop Safety, for more detailed requirements.

6.13 Personal Protection

When engineered controls cannot eliminate a workplace hazard entirely, PPE may be employed to ensure the employee's safety. The PPE specified for a task may require head, hand, foot, or body protection, or hearing or respiratory protection, or a combination of those devices. Refer to Chapter 33: Personal Protection Equipment, for a description of the various types of PPE and the requirements for their use.

6.14 Compressed Gas Cylinders

Compressed gas cylinders contain an enormous amount of energy, but they are safe when properly used and stored. Safe handling of gas cylinders is enhanced by the following practices:

1. Cylinders shall be handled with care. They shall be secured during transit and shall not be dropped, dragged, rolled, slid, or permitted to strike each other.
2. Cylinders shall be moved using a suitable cart or hand truck. Carts and trucks shall not obstruct or be left unattended within any part of an exit corridor, stairway entrance or building exit door. Cylinders that contain hazardous materials with a National Fire Protection Association Placard Hazard Rating of 3 or 4 and are transported within exit corridors or enclosures shall be transported on a cart or truck with the following requirements:
 - Carts and trucks shall have a stable base and shall contain means of restraining cylinders to prevent their movement. Gas cylinders shall be individually restrained.
 - Carts and trucks shall have means to safely control movement, such as stops or speed reduction devices.
 - Carts and trucks shall be of substantial construction and shall be compatible with the materials being transported.
 - Incompatible materials shall not be transported on the same cart or truck.
3. Cylinders that contain toxic gases shall always be stored in the designated exhausted gas cabinets or exhausted enclosures.
4. The valve protection caps shall be left on each cylinder until it has been secured in a proper cylinder restraint or within a stand and is ready for use. Cylinders that contain highly toxic materials shall have their valve outlets capped or plugged with an approved closure device.
5. Liquefied compressed gas containers, cylinders, and tanks, except for those designed for use in the horizontal position, and all compressed gas cylinders and tanks that contain non-liquefied gases shall be used in a "valve end up" upright position, no more than 45 degrees from the vertical. Non-flammable gases may be used in the inverted position when the liquid phase is used, provided the tank or cylinder is properly secured and the dispensing apparatus is designed for liquefied use. Exception: Compressed gas containers, cylinders, and tanks with a water volume less than 1.3 gallons.

6. Ropes, chains, or slings shall not be used to suspend compressed gas cylinders unless provisions at the time of manufacture have been made on the container for appropriate lifting attachments, such as lugs.
7. Safety devices on cylinders shall neither be altered nor tampered with.
8. Empty cylinders may not be connected to full cylinders on a piping system. A dangerous backflow may occur.
9. Cylinders stored in the open shall not be exposed to direct sunlight or other elements that cause elevated temperatures above 125 degrees F. Cylinders may be stored in the open, but in such cases should be protected against extremes of weather and, to prevent rusting, from the dampness of the ground.
10. When welding, do not strike an arc against a compressed gas cylinder. Do not place cylinders where they may become part of an electric circuit.
11. Wear safety glasses while turning on or adjusting regulators and valves.

6.15 Protective Lockout and Tagging of Equipment

Machines, equipment, appliances, liquid, and gaseous piping systems and power distribution systems contain energy sources necessary to their function. These energy sources can be very hazardous to personnel who perform work or maintenance on the machines. Examples of some hazardous energy sources are energized electrical components, pressurized systems (e.g., air, hydraulic, steam), and thermal and kinetic energy systems. The best method of ensuring that the hazards are controlled during maintenance is to isolate (i.e., lockout and tag) the associated energy sources until designed safeguards are reinstalled.

Because of the hazards associated with equipment, only trained, experienced, and authorized personnel may work on equipment and systems. Authorized personnel will use the requirements and guidance provided in Chapter 31: Lockout/Tagout.

HOLD-OFF and **SPECIAL CONDITIONS** tags are used to call attention to situations where maintenance work that requires equipment lockout is being performed on equipment and/or where such equipment may be operated only under certain specific, limited conditions. These tags must be honored. **THE LIVES OF WORKERS DEPEND ON IT.** Only specifically authorized personnel may remove or otherwise modify a tag.

6.16 Confined Space Entry

Confined spaces are those areas where an explosive, toxic, or oxygen-deficient atmosphere could have accumulated because of the shape of an area, restricted access, or proximity to activities producing such conditions. Examples are holes in the ground large enough to get one's body into, tanks (both above and below ground), and underground sewer or storm systems. No one may enter a posted confined space unless the requirements of Chapter 26: Confined Space Entry, are satisfied.

6.17 Materials Handling

6.17.1 General Work Practices

6.17.1.1 Safe Work Practices

Most injuries occurring in connection with material handling can be prevented by following safe work practices. Supervisors of work operations involving the handling of materials will develop standard procedures to assure safe and efficient performance of work. General precautions for manual handling of equipment include:

1. Inspect materials for slivers, jagged edges, burrs, rough or slippery surfaces. Use gloves if necessary.
2. Get a firm grip on the object being lifted. Maintain that grip while lifting and carrying. Set the object down before changing or adjusting the grip.
3. Keep fingers away from pinch points, especially when setting down materials or passing close to stationary objects.
4. When handling lumber, pipe, or other long objects, keep hands away from the ends to prevent them from being pinched.
5. Wipe off greasy, wet, slippery, or dirty objects before trying to handle them.
6. Keep hands free of oil and grease.
7. Consider the size, weight, and shape of the object to be carried. Do not lift more than you can handle comfortably.
8. Prior to lifting, set feet solidly. One foot can be slightly ahead of the other for increased effectiveness. Feet should be far enough apart to provide good balance and stability (approximately the width of the shoulders).
9. Get as close to the load as possible and then bend your legs about 90 degrees at the knees.
10. Keep the back as straight as possible. It may be far from being vertical, but it should not be arched. Bend at the hips, not the middle of the back.
11. Straighten the legs to lift the object, at the same time bringing the back to a vertical position. A good tip is to look up at the sky or ceiling when beginning a lift.
12. Never carry a load that you cannot see over or around. Make sure the path of travel is clear. Carry the object close to the body.
13. Never turn at the waist to change direction or to put an object down. Turn the whole body and crouch down to lower the object.
14. To keep hands from being pinched against the floor, put one corner of a box or similar object down first, preferably on light cribbing, so that the fingers can be removed from under the sides.
15. The Safety Office should analyze lifting and moving actions involving heavy loads and/or highly repetitive actions for ergonomic aspects.

6.17.1.2 Safe Techniques for Specific Situations

1. If an object to be moved is too heavy or bulky, obtain help or use a material-handling device.
2. Before lifting a load, consider the distance to be traveled and the length of time the grip has to be maintained. If the load is to be carried a long distance, or up stairs or ramps, obtain assistance.
3. To place an object on a bench or table, first set it on the edge of the bench or table and push it far enough onto the support to prevent it from falling. Release it gradually as you set it down. Move it in place by pushing with the hands and body from a position in front of the object. This method prevents fingers from getting pinched.
4. It is especially important that an object placed on a bench or other support be securely placed so that it will not fall, tip over, or roll off. Supports should be correctly located, should be strong enough to carry the load, and equal to or larger in area than the load being moved.

5. Heavy objects, such as lathe chucks, dies, and other jigs and fixtures should be stored at approximately waist height.
6. To change direction, lift the object to the carry position, and turn the entire body, including the feet. Do not twist your body. In repetitive work, the person and the material should be positioned so the person will not have to twist the body while moving the material.
7. To deposit an object manually in a tight space, it is safer to slide it into place with the hands in the clear, rather than to lift it.

6.17.1.3 Improper Practices

Improper practices cause the majority of injuries associated with handling materials. Injuries include sprains and strains, fractures, and bruises. They are caused by a variety of actions, including improper lifting, incorrect gripping, unsecured stacking, failure to observe proper foot or hand clearances, using unsafe walking surfaces, or failure to use protective equipment. This highlights the need for training of personnel in the proper procedures and techniques for safe handling of material. The assistance of the Safety, Health, and Environmental Office is available for developing training programs.

6.17.2 Manual Trucks & Carts

6.17.2.1 Hand Trucks And Carts

Hand trucks and carts of many types may be used to move materials. These devices offer significant mechanical advantages if used properly. Advantages include the ability to move relatively heavy loads, no time limit on handling the load, ability to secure the load, movement with a low center of gravity, and good mobility with the capability to precisely place the load. Operators should wear approved gloves and safety shoes as appropriate, when using such equipment.

6.17.2.2 Two-Wheeled Trucks, Hand Trucks and Wheelbarrows

Two-wheeled trucks and wheelbarrows should be kept in good condition. Axles should be kept well greased. The type of truck most suitable for the work at hand should be used. Two-wheeled trucks may appear as if they are easy to handle, but there are safe procedures that must be followed, including:

1. Keep the center of gravity of the load as low as possible.
2. Place heavy objects below lighter objects. When loading trucks, keep feet clear of the wheels.
3. Place the load so the axle will carry the weight, not the handles.
4. Place the load so it will not slip, shift, or fall. Load only to a height that will allow a clear view ahead.

When a two-wheeled truck or wheelbarrow is loaded in a horizontal position, raise it to traveling position by lifting with the leg muscles and keep the back straight. Observe the same principle in setting a loaded truck or wheelbarrow down; the leg muscles should do the work.

1. Let the truck carry the load. Operator action should be limited to balance and push.
2. When going down an incline, keep the truck ahead. When going up, keep the truck behind (this applies to four-wheeled as well as two-wheeled trucks).
3. Only walk backwards with a hand truck when going up ramps or stairs or backing over obstructions.
4. Move trucks at a safe speed. Do not run. Keep trucks constantly under control.

5. Pay special attention to the deck surface. Watch for obstructions, irregularities, slopes, and damaged stair tread edges.

6.17.2.3 Four-Wheel Trucks

Four-wheeled truck operation follows similar rules to those for two-wheeled trucks. Special emphasis should be placed on proper loading, however. Four-wheeled trucks should be evenly loaded to prevent tipping. Four-wheeled trucks should be pushed rather than pulled, except for a truck that has a fifth wheel and a handle for pulling. Trucks should not be loaded so that operators cannot see where they are going. If there are high racks on the truck, two persons should move the vehicle, one to guide the front end and the other to guide the back end. Handles should be placed at protected places on the racks or truck body so that passing traffic, walls, or other objects will not crush or scrape the operator's hands. Truck contents should be arranged so they will not fall or be damaged in case the truck or the load is bumped.

6.17.2.4 Fifth-Wheel Trucks

Fifth-wheel trucks, provided with a steering handle attached to a swiveling axle, should be pulled by the handle and never pushed, except when maneuvering the truck into a certain position. Handles should be hooked or chained out of the way when trucks are parked or standing. On a large truck of this type, such as a baggage truck, a wheel should be chained to the frame to prevent the truck from moving when it is standing.

6.17.3 General Precautions

The three main hazards encountered with hand trucks are:

- Running the wheels off bridge plates or platforms.
 - Colliding with other trucks or obstructions.
 - Jamming hands between the truck and other objects.
1. Workers should operate trucks at a safe speed and maintain constant control. Special care is required at blind corners and doorways. Properly placed convex mirrors can aid visibility in these locations.
 2. When not in use, a truck should be stored in a designated area, not parked in aisles or other places where it presents a tripping hazard or traffic obstruction. Trucks with drawbar handles should be parked with handles in the "up" position. Two-wheeled trucks should be stored on the side of the aisle with handles leaning against a wall or the next truck. Wheels of trucks not being used should be blocked.

6.17.4 Safe Storage and Warehousing

The following rules apply to the storage of materials and warehousing:

1. Storage areas must be kept free from accumulation of materials that constitute hazards of tripping, fire, explosion, or harboring vermin.
2. Aisles must be at least three feet wider than the widest-loaded vehicle. Materials may not be stored in aisles. Permanent aisles and passageways are to be appropriately marked. Materials must not block exit paths.
3. Storage of material must not create a hazard. Materials stored in tiers must be stacked, blocked, interlocked, and limited in height, so they are stable and secure against sliding or collapse.
4. Materials stored together (in any one stack) must be chemically compatible in order to minimize fire hazards. For assistance on storage compatibility, consult the Environmental Health and Safety Office.
5. Warehouses must be protected by automatic fire detection and sprinkler systems.

6. General illumination of warehousing areas and receiving areas should be at least 5 foot-candles for rough and bulky materials, 10 foot-candles for ordinary materials, and 30 foot-candles for materials requiring careful handling.
7. All buildings used for material storage shall contain securely affixed postings of the approved floor loadings. Postings may not be modified or removed. Load limits may not be exceeded at any time.
8. Warehouse Facilities shall pass the monthly ASAP inspection.

6.18 Safety Training

Supervisors are required to ensure that all employees are adequately trained to conduct their work assignment safely. Safety training may include formal classes, written tests, reading assignments, one-on-one discussions, on-the-job training, and skill demonstrations. Supervisors should identify the safety training requirements for all employees or tasks for which they are responsible.

Training frequency will vary with respect to the nature of the work environment and the skill/knowledge level required to be maintained. Supervisors should determine whether initial training is sufficient or if periodic training is required to maintain the desired level. Documentation of all training activities is essential. Documentation includes the subject of the training, date, and the personnel trained.

No employee may perform work with hazardous materials, hazardous wastes, radioactive wastes, and lasers or in hazardous locations (e.g., confined spaces) without the designated safety training. Contact the Safety Office, or access the Code QH Home Page for additional information on Safety, Health, and Environmental training.

6.19 Deviation/Waiver

The purpose of a Deviation or Waiver is to provide management acceptance of a hardware part or facility construction that does not conform to applicable codes, requirements, or specifications. A Deviation refers to a nonconformity during the planning or design stage of an item. A Waiver is required during an item's fabrication or after an inspection or test, when the item is found to depart from specified requirements, but it is considered for use "as is" or after modification. A Deviation or Waiver can be requested by submitting ARC Form 547 through the cognizant Division Chief to the Chief of the Systems Safety and Mission Assurance Office. This office determines what additional approval signatures are required and whether or not the request for a ARC 762, Deviation/Waiver should be approved, presented to the Executive Safety Board, or otherwise briefed to the Center management.

6.20 References

- Supervisor's Safety Manual, 10th Edition, 1992, National Safety Council, Chicago, Illinois 60611.
- Accident Prevention Manual for Industrial Operations, 10th Edition, 1992, National Safety Council, 444 North Michigan Avenue, Chicago, Illinois 60611.
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